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NZQA

NEW ZEALAND QUALIFICATIONS AUTHORITY
MANA TOHU MĀTAURANGA O AOTEAROA

For Supervisor's use only

Level 3 Statistics and Modelling, 2010

90643 Solve straightforward problems involving probability

Credits: Four
9.30 am Monday 15 November 2010

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

Make sure you have a copy of the Formulae and Tables Booklet L3–STATF.

You should answer ALL the questions in this booklet.

Show ALL working for ALL questions.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–8 in the correct order and that none of these pages is blank.

YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.

For Assessor's use only	Achievement Criteria				
Achievement		**Achievement with Merit**		**Achievement with Excellence**	
Solve straightforward problems involving probability.		Solve probability problems.		Apply probability theory.	
Overall Level of Performance					

You are advised to spend 45 minutes answering the questions in this booklet.

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QUESTION ONE

(a) A game of chance involves tossing a **biased** coin 3 times. The table below shows the probability distribution of the random variable, H, the number of heads occurring.

h	0	1	2	3
$\mathbf{P}(H = h)$	27/125	54/125	36/125	8/125

Calculate the variance of H.

(b) A player wins \$2.50 for each head that occurs. The organisers wish the expected profit per game to be \$0.60.

Calculate, to the nearest dollar, the amount the organisers should charge each player per game.

(c) The organisers operate two other games. Game A costs \$5 to play. Game B costs \$4 to play. Game A and Game B are played independently. The number of times each game is played varies from day to day. For Game A, the number of times the game is played per day has a mean of 26.3, with standard deviation of 4.4. For Game B, the number of times the game is played per day has a mean of 32.7, with standard deviation of 7.8.

Let the random variable A be the number of times game A is played.

Let the random variable B be the number of times game B is played.

Let the random variable \$$T$ be the total amount spent to play the games.

Calculate the mean and standard deviation of T.

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QUESTION TWO

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A table tennis tournament is being held.

(a) The players in the tournament hit the ball in two ways, by either smashing it or not smashing it. The probability that a randomly selected shot by a player is a smash is 0.55. The probability that a spectator will be able to follow the path of the ball if it is a smash shot is 0.4. The probability that a spectator can follow the path of the ball if it is NOT a smash shot is 0.7.

Calculate the probability that a spectator will be able to follow the path of the ball.

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(b) Table tennis balls come in boxes of 12. Before a box is used, the balls are checked. A sample of four balls is selected randomly and each ball in the sample is tested. If the sample contains more than one faulty ball, the box is rejected.

Suppose a box contains 3 faulty balls.

Find the probability that the box will be rejected.

(c) The players in the final are Ani and Bertha. The score in the final game reaches 20–20. The final game will continue until one player has scored two more points than the other. It is known from previous games between Ani and Bertha that the probability of Ani winning each point is 0.6.

Find the probability that Ani wins the game after exactly 8 further points.

QUESTION THREE

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A survey on gardening was conducted where two of the questions were:

- Do you have a vegetable garden?
- Do you live in an urban area?

The results of these questions are shown in the following table.

	Live in an urban area	**Do not live in an urban area**
Have a vegetable garden	42	72
Do not have a vegetable garden	28	8

(a) Let U be the event: live in an urban area, and
let V be the event: have a vegetable garden.

Are the events U and V independent?

Justify your answer statistically.

(b) Find the probability that a randomly selected survey respondent who has a vegetable garden lives in an urban area.

(c) The survey also produced the following information from a study of 70 gardens.

Amongst other vegetables grown:

48 gardens had peas, 47 gardens had tomatoes, 27 gardens had beans, 12 gardens had peas, tomatoes and beans, 15 gardens had beans and peas only, and 20 gardens had tomatoes only.

Using this information, calculate the probability that any garden chosen at random from those surveyed will have peas if it has tomatoes.

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Extra paper for continuation of answers if required.
Clearly number the question.

Assessor's use only

Question number